Remarks

In view of the above amendments and the following remarks, favorable reconsideration of the outstanding office action is respectfully requested.

Attached hereto is a page entitled "Version of Markings to Show Changes Made."

Claim Status

Claims 1-37 remain in this application. Claims 1-9, 15-18, 31 and 35-37 stand rejected. Claims 10-14, 19-30 and 32-34 stand objected to. Claims 10, 9 and 32 have been amended.

Drawings

Copies of the formal/informal drawings previously filed in this application are submitted with this Response, including proposed revisions marked in red for the Examiner's review and approval. Those proposed revisions to the figures include additional labels and numbers.

Allowed Claims/Subject Matter

Applicant notes with appreciation that the Examiner has indicated the subject matter of claims 10-14, 19-30 and 32-34 are patentable, and would be allowable if rewritten in independent form. Accordingly claims 10, 19 and 32 have been re-written in independent form. Claims 11-14 depend from claim 10 as their base claim and, therefore, expressly incorporate the subject matter of claim 10. Claims 11-14 depend from claim 10 as their base claim and, therefore, expressly incorporate the subject matter of claim 10. Claims 20-30 depend from claim 19 as their base claim and, therefore, expressly incorporate the subject matter of claim 19. Claims 33 and 34 depend from claim 32 as their base claim and, therefore, expressly incorporate the subject matter of claim 32. Therefore, claims 10-14, 19-30 and 32-34 should now be allowable.

§ 103 Rejections

Claims 1-3, and 15-17, 31, 35, and 36 stand rejected under 35 U.S.C. § 103(a) as being unpatentable for obviousness over Maxham in view of Cspikes et al. in view of Iwano et al.

The Maxham reference discloses an optical fiber network that utilizes a two stage optical amplifier module. This amplifier module includes at least one integral pump dedicated to each amplification stage. (See Fig. 3 of the Maxham reference.) That is, this reference teaches that the pumps shoild be inclided in the amplifier module. Therefore, the functional groupings disclosed the Maxham reference are different from those taught by the applicants.

Furthermore, applicants' claims call for an input module (referred to as a sub-unit) "comprising a plurality of input stage components". Similarly, applicants' claims call for an output module "comprising a plurality of output stage components". No such plurality of input or output stage components are shown in units 48 and 50 (illustrated in See Fig. 3 of the Maxham reference). Moreover, units 48 and 50 are WDM couplers that are utilized to separate or combine East and West propagating signals into a transmission line. Unit 48 provides East, propagating signal to the optical amplifier 30. This signal: (i) corresponds to the optical input signal indicated by the signal transmission arrow 5 (see, for example, Fig. 5 of applicants' specification) provided from the transmission network to the applicants' amplifier, and (ii) still needs to be propagate through inputs components prior to amplification. That is, units 48 and 50 of the Maxham reference are not amplifier's input components because they merely separate two sets of signals prior to signal entry into the amplifier. Thus, although these WDMs 48 and 50 direct an input signal to the amplifier and accept the output signal provided by the amplifier, they constitute a part of a transmission system, and do not form a part of the optical amplifier. For example, Figure 5 of the Maxham reference clearly shows that these WDMs are not forming a part of the amplifier because they are located in a separate block, outside of the block termed "optical amplifier".

Applicants described exemplary input module and exemplary output module in their specification. Applicants' input modules include all input components. That is all of applicant's input components are placed into the input module. Similarly, applicants' output modules include and all output components. That is all of applicants' output components are placed into the output module. For example, applicants' figure 5 discloses an input module 30 that accepts incoming input signal indicated by a signal transmission arrow 5 and then

processes it through several input components. These input components are, for example, an isolator, a supervisory channel drop unit 34, a receiver 36 and a tap coupler connected to a photodiode 42. No such input components are present in units 48, 50 of the Maxham reference. Furthermore, Figure 4 of the Maxham reference clearly shows a large number of filters (SCWs) located in many different positions throughout the amplifier and a input signal tap coupler (as well as the output signal tap coupler) located within the amplification module itself. These couplers are shown in the enclosed illustration A, which corresponds Fig. 3 of the Maxham reference. Thus, contrary to the Examiner's assertion, the Maxham reference does not disclose an amplifier containing an input module and an output module, as called for by the applicants' claims.

The Cspikes reference does disclose an optical amplifier that utilizes a separate pump module. However, the input and output components are included in cassettes that also contain amplification components.

Moreover, although the Csipkes reference teaches a "modular optical amplifier" it does not suggest that it would apply to amplifiers that are built in a manner different from that of the specific cassette configuration taught by Csipkes reference. It was Applicants who realized that a the optical amplifier may be configured in a easily configurable manner by having pump subunits, telemetry drop (input) subunits, telemetry add (output) subunits and pump subunits. As stated above, the Csipkes reference does not teach separate amplification subunits and additional input and output subunits. In fact, the Csipkes reference teaches that the input components should be within the first amplification stage cassette (cassette 1) and that the output components should be in the second amplification stage (cassette 3). This is shown in Figure 1 of the Csipkes reference. That is, applicants' claims specify different partitioning of the components that what is disclosed by the Csipkes reference. Accordingly, because the claimed references, in combination, do not disclose all of the claimed features, Applicant's claims 1–3, 15-17, 31, 35 and 36 are not obvious over the cited art.

The Iwano reference also does not show, teach or disclose an optical amplifier containing a separate input module and a separate output module, each including a plurality of input or output components. Therefore, because the three references, in combination, do not disclose all of the claimed features of claims 1–3, 15-17, 31, 35 and 36, these claims are not obvious over Maxham in view of Cspikes et al. in view of Iwano et al.

Finally, the Iwano reference discloses very specific connectors- i.e., "connectors developed for multiple optical fiber connections-i.e., "connectors developed for multiple

optical connections between n a printed board and a back panel" (see abstract). This reference does not specify, teach or imply that the disclosed connectors could be used to connect amplifier modules to one another. Absent such suggestion in the reference itself, applicants submit that claims 1–3, 15-17, 31, 35 and 36 are not obvious over the cited references.

With respect to **claim 16**, page 4 of the Office Action states: "Maxham teaches providing a design for the first through fourth amplifier utilizing a plurality of optical components. See figures 3, 4 and 5. Each of the amplifiers from figures 3 and 4 may be incorporated to fit amplifiers of figure 5." However, even if we assume, arguendo, that this assertion is correct, the Maxham reference does not teach or even imply a method of making amplifier that includes the steps of

(i) providing a plurality of different pump subunits, different optical signal amplifying subunits and different amplifier input and output subunits, wherein the providing step includes providing (separate) design for each of four amplifiers;

(ii) (ii) selecting one desired sub-unit from each of said plurality of different pump sub-units, different optical signal amplifying sub-units, different input sub-units and different output sub-units; and

(iii) (iii) optically connecting each of said desired pump, optical signal amplifying, input and output sub-units on a support board via a plurality of pluggable fiber optic connectors to make said optical fiber amplifier.

Therefore, because the cited references, in combination do not disclose all of the features of claim 16, claim 16 is not obvious over the cited art.

Claim 17 depends from claims 15 and 16 and therefore expressly incorporates the language of these claims. As stated directly above, these claims specify that in order to manufacture an amplifier one needs to perform the providing step (i) and the selecting step (ii). Claim 17 further specifies that the providing step "further includes: for each of said first, second, third and fourth optical fiber amplifier, dividing said plurality of optical components into at least four functional groups, including a pump components group, an optical signal amplifying components group, an input components group and an output components group, each of said functional groups comprising one or more optical components". Page 4 of the Office Action, in referring to claim 17 states that "it would have been obvious to divide the components into functional groups to provide an organized

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inventory." However, this feature is taught by the applicants. It is not disclosed by any of the cited references. The references also do not disclose the benefit cited by the Examiner. None of the cited references teach, suggest, or imply that one needs to design four amplifiers, divide the required amplifier components (of each of the amplifiers) into at least four functional groups (ex: input component group, amplification component group, pump component group, output component group) and then select a desired subunit (module) from a variety of different pump subunits, input subunits, amplification subunits, poutput subunits those subunits that make a specific amplifier that is being made. It is well established that the use of applicants' own teaching or hindsight is not permissible when ascertaining whether or not the invention is obvious over the prior art. Therefore, absent such teaching <u>by the cited references themselves</u>, claim 17 is not obvious over the cited references.

With respect to **claim 18**, page 5 of the Office Action states "it would have been obvious to further divide the pump modules into a first subgroup with pumps of wavelength λ_1 and a second subgroup with pumps of wavelength λ_2 in order to further organize the inventory." However, this suggestion is not present in either of the three cited references. <u>The use of applicants own teaching or hindsight is not permissible when ascertaining whether or not the invention is obvious over the prior art</u>. Therefore, absent such teaching <u>by the cited references themselves</u>, claim 18 is not obvious over the cited references.

With respect to **claim 31**, page 5 of the Office Action states "It is well known in the art that modules, connected to a backplane may be arranged on a board in order to provide support for the optical components and easy connection to the backplane (similar to card connections to a motherboard in a computer". Applacants respectfully disagree with this assertion. <u>The card-mother board like connections or assembly in a field of optical amplifiers is taught by the applicants and is not taught, suggested or implied by the cited references</u>. Absent such teaching <u>by the cited references themselves</u>, claim 31 is not obvious over the cited references.

With respect to **claim 35**, page 6 of the Office Action states that the testing steps recited in the claimed method are obvious. However, none of the cited references suggests that one of the benefits of modular assembly is testing of each (i.e., input, output, pump and amplification).module prior to its assembly into an overall amplifier. The cited references are either not directed to amplifier assembly (as Iwano) or describe an optical amplifier with much fewer modules. (For example the Maxham reference discloses the input signal component (input signal tap) and the output signal component (output signal tap) in the

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amplifification module. This is also done in the Scipkes device.) It was applicants who realized that it is much harder to de-bug a problem in a larger amplifier assembly then to test modules separately. . Absent such teaching by the cited references themselves, claim 35 is not obvious over the cited references.

With respect to **claim 36**, page 7 of the Office Action states that the "it would have been obvious to mount a second accepted pump module on said substrate; optically conect said pump module to said substrate; and test said second accepted pump module in order to supply additional optical power source to the amplifier wherein the functionality of the optical power source is verified and allow for a soft shutdown". Applicants respectfully disagree with his assertion. None of the cited references discloses this claimed features. It was Applicants who disclosed and taught the desirability of having this type of modular assembly and suggested the desirability of having a second pump module being tested on the substrate. Absent such teachings or disclosure present in the cited references themselves, claim 36 can not be held obvious over the cited references.

Claims 4, 6, and 7 stand rejected under 35 U.S.C. § 103(a) as being unpatentable for obviousness over Maxham in view of Cspikes et al. in view of Iwano et al. as applied to claim 1 above, and further in view of Ohshima et al.

Page 8 of the Office Action states "It would have been obvious to modify the apparatus by supplying a plurality of pump modules to provide redundancy". However, this reason or "benefit" is not disclosed nor suggested in any of the cited references. Furthermore, redundancy of components is very expensive and those with skill in the art, in order to minimize manufacturing cost, save foot print space and minimize assembly time, try to minimize the number of components, not increase them.

Furthermore, claims 4, 6 and 7 depend from claim 1 as their base claim and, therefore, are not obvious for the same reasons that claim 1 is not obvious. Finally, claim 4 specifies that the fifth pluggable subunit is mounted on a support board and includes a pump sourceof wavelength λ_2. This feature is not disclosed by the cited references. Claims 6 and 7 depend from claim 4 and, therefore, expressly incorporate the language of claim 4. Therefore, claims 4, 6 an d 7 are not obvious over Maxham in view of Cspikes et al. in view of Iwano et al. as applied to claim 1 above, and further in view of Ohshima et al.

Claims 5, 8, and 9 stand rejected under 35 U.S.C. § 103(a) as being unpatentable for obviousness over Maxham in view of Cspikes et al. in view of Iwano et al. further in view of Ohshima et al. as applied to claims 4, 6, and 7 above, and further in view of Becker et al.

Claims 5, 8 and 9 depend from claims 1 and 4 and, therefore, are not obvious for the same reasons that claims 1 and 4 are not obvious. Furthermore, with regard to claim 5, the Office Action is suggesting a combination of four (4) references, with reasons to modify the combination of Maxcam, Spikes and Iwano and a further reason to modify resultant device after combining it with the Oshima reference. The number of combined and cited references and the additional suggested modifications are in itself an indication for the unobviousness of claim 5.

Therefore, claims 5, 8 and 9 are not obvious over Maxham in view of Cspikes et al. in view of Iwano et al. further in view of Ohshima et al. as applied to claims 4, 6, and 7 above, and further in view of Becker et al.

Claim 37 stands rejected under 35 U.S.C. § 103 as being unpatentable over Cspikes et al. in view of Iwano et al.

Claim 37 specifies manufacture of n (n>2) different types of optical amplifiers in one manufacturing line a providing at least n types of subunits in at least one functional group. This feature is not described in either the Cspikes reference, or in the Iwano reference. Therefore, because the cited references, in combination, do not disclose all of the features of claim 37, this claim is not obvious over Cspikes et al. in view of Iwano et al.

Conclusion

Based upon the above amendments, remarks, and papers of record, Applicant believes the pending claims of the above-captioned application are in allowable form and patentable over the prior art of record. Applicant respectfully requests reconsideration of the pending claims 1-37 and a prompt Notice of Allowance thereon.

Applicant believes that no extension of time is necessary to make this Response timely. Should Applicant be in error, Applicant respectfully requests that the Office grant such time extension pursuant to 37 C.F.R. § 1.136(a) as necessary to make this Reply timely, and hereby authorizes the Office to charge any necessary fee or surcharge with respect to said

time extension or any fees associated with the addition of independent claims to the deposit account of the undersigned firm of attorneys, Deposit Account 03-3325.

Please direct any questions or comments to Svetlana Z. Short at (607)974-0412.

Respectfully submitted,

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Date of Signature

VERSION OF MARKINGS TO SHOW CHANGES MADE

What is claimed is:

1. An optical fiber amplifier assembly, comprising:

a support board;

a first pluggable sub-unit mounted onto said support board, said first pluggable sub-unit comprising a first pump source having a pump wavelength of λ_1;

a second pluggable sub-unit mounted onto said support board, said second pluggable sub-unit comprising a plurality of first stage optical signal amplifying components;

a third pluggable sub-unit mounted onto said support board, said third pluggable sub-unit comprising a plurality of input stage components; and

a fourth pluggable sub-unit mounted onto said support board, said fourth pluggable sub-unit comprising a plurality of output stage components;

said second pluggable sub-unit being optically connected to each of said first, third and fourth pluggable sub-units.

2. **(Previously Amended)** The optical amplifier assembly of claim 1, further comprising a first, third and fourth fiber-optic connector, wherein said second pluggable sub-unit is optically connected to each of said first, third and fourth pluggable sub-units via said first, third and fourth fiber-optic connector, respectively.

3. The optical amplifier assembly of claim 1, wherein said second pluggable sub-unit comprises a plurality of second stage optical signal amplifying components.

4. The optical amplifier assembly of claim 3, further comprising a fifth pluggable sub-unit mounted onto said support board, said fifth pluggable sub-unit having a second pump source that has a pump wavelength of λ_2 and which is optically connected to said second pluggable sub-unit via a fifth board mountable fiber-optic connector.

5. The optical amplifier assembly of claim 4, wherein said plurality of first and second stage optical signal amplifying components comprises in a direction of an optical signal transmission a first wavelength-division multiplexing coupler serially connected to a first rare-earth doped optical fiber coil, said first rare-earth doped optical fiber coil being serially

connected to a first optical isolator, said first optical isolator being serially connected to a gain flattening filter, said gain flattening filter being serially connected to a second wavelength-division multiplexing coupler, said second wavelength-division multiplexing coupler being serially connected to a second rare-earth doped optical fiber coil.

6. The optical amplifier assembly of claim 4, wherein said pump wavelength λ_1 of said first pump source is approximately equal to said pump wavelength λ_2 of said second pump source.

7. The optical amplifier assembly of claim 4, wherein said pump wavelength λ_1 of said first pump source is different than that of said pump wavelength λ_2 of said second pump source.

8. The optical amplifier assembly of claim 6, wherein each of said pump wavelength λ_1 and λ_2 is approximately 980 nanometers.

9. The optical amplifier assembly of claim 7, wherein said pump wavelength λ_1 of said first pump source is 980 nanometers and wherein said pump wavelength λ_2 of said second pump source is 1480 nanometers.

10. **(Amended)** An optical fiber amplifier assembly, comprising:

a support board;

a first pluggable sub-unit mounted onto said support board, said first pluggable sub-unit comprising a first pump source having a pump wavelength of λ_1;

a second pluggable sub-unit mounted onto said support board, said second pluggable sub-unit comprising a plurality of first stage optical signal amplifying components and a plurality of second stage optical signal amplifying components;

a third pluggable sub-unit mounted onto said support board, said third pluggable sub-unit comprising a plurality of input stage components; and

a fourth pluggable sub-unit mounted onto said support board, said fourth pluggable sub-unit comprising a plurality of output stage components;

said second pluggable sub-unit being optically connected to each of said first, third and fourth pluggable sub-units;

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a fifth pluggable sub-unit mounted onto said support board, said fifth pluggable sub-unit having a second pump source that has a pump wavelength of λ_2 and which is optically connected to said second pluggable sub-unit via a fifth board mountable fiber-optic connector, said pump wavelength λ_2 of said second source being different than that of said pump wavelength λ_1 of said first pump source [The optical amplifier assembly of claim 9,]

wherein said plurality of input stage components comprises in said direction of said optical signal transmission a first tap coupler, and a first photodetector serially connected to said tap coupler.

11. The optical amplifier assembly of claim 10, wherein said plurality of input stage components further comprises in said direction of said optical signal transmission a second optical isolator serially connected to a supervisory channel drop unit, a receiver serially connected to said supervisory channel drop unit, a variable optical attenuator serially connected to said supervisory channel drop unit at a first end and to said first tap coupler at an opposite end.

12. The optical amplifier assembly of claim 11, wherein said plurality of output stage components comprises in said direction of said optical signal transmission:

a second tap coupler, and a second photodetector serially connected to said second tap coupler.

13. The optical amplifier assembly of claim 12, wherein said plurality of output stage components further comprises in said direction of said optical signal transmission: a third optical isolator serially connected to said second tap coupler, a supervisory channel add unit serially connected to said third optical isolator and a transmitter serially connected to said supervisory channel add unit.

14. The optical amplifier assembly of claim 13, wherein each of said first, third, fourth and fifth board mountable fiber-optic connectors comprises a respective first-half member and a respective mating second-half member, each of said respective first-half members being mounted along an edge of each of said first, third, fourth and fifth pluggable sub-unit, respectively, and each of said respective mating second-half members being mounted along the edges of said second pluggable sub-unit.

15. A method of making an optical fiber amplifier comprising the steps of:

providing a plurality of different pump sub-units, different optical signal amplifying sub-units, different input sub-units and different output sub-units;

selecting one desired sub-unit from each of said plurality of different pump sub-units, different optical signal amplifying sub-units, different input sub-units and different output sub-units;

optically connecting each of said desired pump, optical signal amplifying, input and output sub-units on a support board via a plurality of pluggable fiber optic connectors to make said optical fiber amplifier.

16. The method of claim 15, wherein said providing step includes the step of first providing a design for each of a first, second, third and fourth optical fiber amplifier, each of said first, second, third and fourth optical fiber amplifier comprising a plurality of optical components.

17. The method of claim 16, wherein said first providing step further includes: for each of said first, second, third and fourth optical fiber amplifier, dividing said plurality of optical components into at least four functional groups, including a pump components group, an optical signal amplifying components group, an input components group and an output components group, each of said functional groups comprising one or more optical components.

18. The method of claim 17, wherein said pump components group is further divided into a first pump components group and a second pump components group, said first pump components group including a first pump laser having an output wavelength of λ_1, said second pump components group including a second pump laser having an output wavelength of λ_2.

19. **(Twice Amended)** A method of making an optical fiber amplifier comprising the steps of:

providing a plurality of different pump sub-units, different optical signal amplifying sub-units, different input sub-units and different output sub-units, said providing step

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including the step of first providing a design for each of a first, second, third and fourth optical fiber amplifier, each of said first, second, third and fourth optical fiber amplifier comprising a plurality of optical components, wherein said first providing step further includes: for each of said first, second, third and fourth optical fiber amplifier, dividing said plurality of optical components into at least four functional groups, including a pump components group, an optical signal amplifying components group, an input components group and an output components group, each of said functional groups comprising one or more optical components;

selecting one desired sub-unit from each of said plurality of different pump sub-units, different optical signal amplifying sub-units, different input sub-units and different output sub-units;

optically connecting each of said desired pump, optical signal amplifying, input and output sub-units on a support board via a plurality of pluggable fiber optic connectors to make said optical fiber amplifier,

[The method of claim 17,] further comprising the steps of:

forming an optical signal amplifying components group, an input components group and an output components group, wherein each of said optical signal amplifying, input and output components groups includes a maximum number of said optical components common to each of said first, second, third and fourth optical fiber amplifiers; and

forming an optical signal amplifying components subset group, an input components subset group and an output components subset group, each of said components subset groups having the minimum number of said optical components common to each of said respective components groups for each of said first, second, third and fourth optical fiber amplifiers.

20. **(Previously Amended)** The method of claim 19, further comprising the steps of:

mounting each of said optical signal amplifying components group on one or more amplifying sub-units, mounting each of said input components group on one or more input sub-units, and mounting each of said output components group on one or more output sub-units;

mounting each of said optical signal amplifying components subset group on one or more amplifying sub-units, mounting each of said input components subset group on one or more

more input sub-units, and mounting each of said output components subset group on one or more output sub-units;

and

mounting each of said first pump components group and said second pump components group on a first pump sub-unit and a second pump sub-unit, respectively.

21. The method of claim 20, further comprising the step of:

arranging each of said optical signal amplifying, input and output components groups and each of said optical signal amplifying, input and output subset components groups on said respective sub-units such that an optical fiber splice between any two of said optical components provides a low-loss and a high strength splice.

22. The method of claim 21, wherein said step of optically connecting comprises:

mounting on an edge of each of said pump sub-units, each of said input sub-units, and each of said output sub-units a first-half member of a board mountable fiber-optic connector that is adapted for mating with a respective second-half member mounted on each of said optical signal amplifying sub-units.

23. The method of claim 22, wherein said optically connecting step further comprises the step of:

first determining which of said optical components on each of said optical signal amplifying, input and output sub-units utilize similar fibers and which of said optical components on each of said optical signal amplifying, input and output sub-units utilize different fibers for each of said first, second, third and fourth optical fiber amplifiers; and

providing optical interfaces between said desired sub-units selected to be optically connected such that each of said optical interfaces provides a low-loss and a high-strength optical fiber splice.

24. The method of claim 23, wherein said step of optically connecting comprises mounting on each of said pump sub-units a first-half member of a first and a second board mountable fiber-optic connector, each first-half member having a first type of an optical fiber and mounting on each of said optical signal amplifying sub-units two second-half members

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of said first and said second board mountable fiber-optic connector, each second-half member being adapted for mating with said first-half members.

25. The method of claim 24, wherein said step of optically connecting comprises mounting on each of said input sub-units a first-half member of a third board mountable fiber-optic connector having a second type of an optical fiber and mounting on each of said optical signal amplifying sub-units a second-half member adapted for mating with said first-half member on said input sub-units.

26. The method of claim 25, wherein said step of optically connecting comprises mounting on each of said output sub-units a first-half member of a fourth board mountable fiber-optic connector that contains an optical fiber of said second type and mounting on each of said optical signal amplifying sub-units a second-half member adapted for mating with said first-half member on said output sub-units.

27. The method of claim 26, wherein said first optical fiber amplifier is a line amplifier.

28. The method of claim 26, wherein said second optical fiber amplifier is an input amplifier having a first net gain.

29. The method of claim 26, wherein said third optical fiber amplifier is an output amplifier.

30. The method of claim 26, wherein said fourth optical fiber amplifier is an input amplifier having a second net gain.

31. The method of making an optical fiber amplifier, comprising the steps of:

arranging on a first pluggable sub-unit a first pump source having a first pump wavelength of λ_1, said first pluggable sub-unit having mounted on an edge a first-half member of a first board mountable fiber-optic connector adapted for mating with a corresponding second-half member mounted on a first edge of a second pluggable sub-unit;

arranging on said second pluggable sub-unit a first group of optical components that effect each of a first signal amplifying stage, a second signal amplifying stage, and the gain

flatness of said optical fiber amplifier, said first group of optical components providing said optical fiber amplifier with a first net gain, said second pluggable sub-unit having mounted on said first edge said second-half member of said first board mountable fiber-optic connector and said second sub-unit having mounted on a second edge a second-half member of each of a third and fourth board mountable fiber-optic connectors;

arranging on a third pluggable sub-unit a second group of optical components that effect an input stage of said optical fiber amplifier, said third pluggable sub-unit having mounted on an edge a first-half member of said third board mountable fiber-optic connector adapted for mating with said respective second-half member mounted on said second pluggable sub-unit;

arranging on a fourth pluggable sub-unit a third group of optical components that effect an output stage of said optical fiber amplifier, said fourth pluggable sub-unit having mounted on an edge a first-half member of said fourth board mountable fiber-optic connector adapted for mating with said respective second-half member mounted on said second pluggable sub-unit;

arranging on a fifth pluggable sub-unit a second pump source having a second pump wavelength of λ_2, said fifth pluggable sub-unit having mounted on an edge a first-half member of a fifth board mountable fiber-optic connector adapted for mating with a corresponding second-half member mounted on said first edge of said second pluggable sum-assembly; and

optically connecting each of said first, third, fourth and fifth pluggable sub-units into said second pluggable sub-unit via said respective first, third, fourth and fifth board mountable fiber-optic connectors to make said optical fiber amplifier.

32. **(Amended)** <u>The method of making an optical fiber amplifier, comprising the steps of:</u>

<u>arranging on a first pluggable sub-unit a first pump source having a first pump wavelength of λ_1, said first pluggable sub-unit having mounted on an edge a first-half member of a first board mountable fiber-optic connector adapted for mating with a corresponding second-half member mounted on a first edge of a second pluggable sub-unit;</u>

<u>arranging on said second pluggable sub-unit a first group of optical components that effect each of a first signal amplifying stage, a second signal amplifying stage, and the gain flatness of said optical fiber amplifier, said first group of optical components providing said</u>

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optical fiber amplifier with a first net gain, said second pluggable sub-unit having mounted on said first edge said second-half member of said first board mountable fiber-optic connector and said second sub-unit having mounted on a second edge a second-half member of each of a third and fourth board mountable fiber-optic connectors;

arranging on a third pluggable sub-unit a second group of optical components that effect an input stage of said optical fiber amplifier, said third pluggable sub-unit having mounted on an edge a first-half member of said third board mountable fiber-optic connector adapted for mating with said respective second-half member mounted on said second pluggable sub-unit; arranging on a fifth pluggable sub-unit a second pump source having a second pump wavelength of λ_2, said fifth pluggable sub-unit having mounted on an edge a first-half member of a fifth board mountable fiber-optic connector adapted for mating with a corresponding second-half member mounted on said first edge of said second pluggable sum-assembly; and

optically connecting each of said first, third, fourth and fifth pluggable sub-units into said second pluggable sub-unit via said respective first, third, fourth and fifth board mountable fiber-optic connectors to make said optical fiber amplifier, [The method of claim 31, further comprising the steps of:]

substituting for said second pluggable sub-unit a sixth pluggable sub-unit which includes a fourth group of optical components that effect each of a first signal amplifying stage, a second signal amplifying stage, and the gain flatness of said optical fiber amplifier, said fourth group of optical components providing said optical fiber amplifier with a second net gain, said sixth pluggable sub-unit having mounted on a first edge a second-half member of each of a first and fifth board mountable fiber-optic connectors and said sixth pluggable sub-unit having mounted on a second edge a second-half member of each of a seventh and eighth board mountable fiber-optic connectors;

substituting for said third pluggable sub-unit a seventh pluggable sub-unit which includes a fifth group of optical components that effect an input stage of said optical fiber amplifier, said fifth group being a sub-set of said second group of optical components, said seventh pluggable sub-unit having mounted on an edge a first-half member of said seventh board mountable fiber-optic connector; and

substituting for said fourth pluggable sub-unit an eighth pluggable sub-unit which includes a sixth group of optical components that are shared in an output stage of said optical fiber amplifier, said sixth group being a sub-set of said third group of optical components;

said eighth pluggable sub-unit having mounted on an edge a first-half member of said eighth board mountable fiber-optic connector;

whereby said first, fifth, seventh and eighth pluggable sub-units are optically connected to said sixth pluggable sub-unit via said respective first, fifth, seventh and eighth board mountable fiber-optic connectors to make a different optical fiber amplifier.

33. The method of claim 32, wherein said optical fiber amplifier comprises:

one of said second and sixth pluggable sub-units that is optically connected to at least one of said first and fifth pluggable sub-units, one of said third and seventh pluggable sub-units and one of said fourth and eighth pluggable sub-units.

34. The method of claim 33, wherein each of said first, third, fourth, fifth, seventh and eighth board mountable fiber-optic connectors couple optical components constructed with similar optical fibers.

35. A method of making an optical fiber amplifier comprising the steps of:

testing the pump power and pump wavelength of a pump module to be connected to an information signal to be amplified;

if the desired pump power and pump wavelength are not present, rejecting said pump module for use in a larger assembly;

if the desired pump power and pump wavelength are present, accepting said pump module for use in a larger assembly;

assembling a signal input module having an input end to be connected to an information signal to be amplified and an output end that terminates in a plug connector;

connecting said signal input module to a source of a known signal representative of an information carrying signal;

measuring the signal present at said output end;

if the desired signal is not present at said output end, rejecting said input module for use in a larger assembly;

if the desired signal is present at said output end, accepting said input module for use in a larger assembly;

assembling a signal output module having an input end to be connected to an information signal to be amplified and an output end that terminates in a plug connector;

connecting said signal output module to a source of a known signal representative of an information carrying signal;

measuring the signal present at said output end;

if the desired signal is not present at said output end, rejecting said output module for use in a larger assembly;

if the desired signal is present at said output end, accepting said output module for use in a larger assembly;

assembling a signal amplifying module including at least an amplifying stage and having an input end and an output end, said input end of said signal amplifying module being connected to a coupler that has a pump input fiber and a signal input fiber and an output fiber;

providing a test information signal to said signal input fiber;

providing pump power to said amplifying stage through said power input fiber;

measuring the signal at the output end of said signal amplifying module;

if the desired signal is not present at said output end, rejecting said signal amplifying module for use in a larger assembly;

if the desired signal is present at said output end, accepting said signal amplifying module for use in a larger assembly;

mounting an accepted signal-amplifying module, an accepted input module, an accepted output module and an accepted pump module on a substrate;

optically connecting each of said input module, output module and pump module to said signal amplifying module; and

testing each of said modules on said substrate.

36. The method of claim 35, further comprising mounting a second accepted pump module having a pump wavelength of λ_2 on said substrate;

optically connecting said second accepted pump module to said accepted signal amplifying module; and

testing said second accepted pump module on said substrate.

37. A method of making n different types of optical amplifiers on one manufacturing line, n being equal to or greater than 2, said method comprising the steps of:

a) for each of the circuits which comprise each of the optical amplifiers to be made, providing a supply of at least four functional groups of sub-units, at least one

functional group containing at least n different types of sub-units, each of the sub-units in 3 of said functional groups including a pluggable optical connector half and each of the sub-units of the fourth of said functional groups including 3 pluggable optical connector halves; and,

b) depending on the specification of the optical amplifier to be made, selecting a specific sub-unit from each of said functional groups and plugging together each of said selected sub-units to form an optical amplifier having the desired specification.

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